Chapter 3
Applying Semantic Agents to Message Communication in E-Learning Environment

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ABSTRACT
A traditional distance learning system requires supervisors or teachers always available online to facilitate and monitor a learner’s progress by answering questions and guiding users. We present an English chat room system in which students discuss course contents and ask questions to and receive from teachers and other students. The mechanism contains an agent that detects syntax errors in sentences written by the online user and also checks the semantics of a sentence. The agent can thus offer recommendations to the user and, then, analyze the data of the learner corpus. When users query the system, this system will attempt to find the answers from the knowledge ontology that is stored in the records of previous user comments. With the availability of automatic supervisors, messages can be monitored and syntax or semantic mistakes can be corrected to resolve learner-related problems.

INTRODUCTION
Distance Learning has become a hot topic in the disciplines of computer science and education in the recent years (Tsang, Hung, Ng, 1999). Furthermore, online learning technologies operating through the Web interface have been developed during the past decade. Because of its ability to incorporate multimedia, the World Wide Web has become an ideal platform for distance learning (Adhvaryu, & Balbin, 1998). Through the Internet, distance learning allows students to enroll in courses and acquire new knowledge. It is a good solution for anyone who does not have enough
time to attend traditional classes. Therefore, distance learning now plays a very important role in education (Harris, Cordero, & Hsieh, 1996; Willis, n.d.; Goldberg, 1996; Goldberg & Salari, 1997; Goldberg, Salari, & Swoboda, 1996).

The advantage of the Internet is information sharing. Many applications on the Internet support information interchange, including Telnet, FTP, e-mail, BBS, and chat-rooms. Each participant can communicate with other participants through text-, voice-, and even video-based messages.

However, it is difficult for instructors to trace the activities and behaviors of learners in distance learning environments. For example, instructors may need answers to the following questions:

- Do the learners understand the teaching context?
- Are learners talking about the issues indicated by the instructor?
- Do the learners really understand the issues being studied in the course?

Therefore, it is quite useful if there are some automatic supervising mechanisms. These mechanisms can monitor discussions and detect mistakes in grammar. This helps students obtain educational training without the need to go to a classroom. Thus, people can teach or learn anywhere any time.

However, there are many problems with distance learning systems. For example, instructors cannot control learners’ activities, instructors cannot stay online forever—the Instructor-off problem—and instructors cannot track of frequent answers and questions (FAQs); thus, learners cannot learn from previous learners and other learners.

To solve the problems mentioned above, this study built up an ontology-based Semantic Agent system that provides supervision and learning-assistance for textual chat rooms. This system was built based on Agent, Link grammar, XML, a learner corpus, and other supporting functions to solve the Instructor-off problems. The system provides a Learning_Angel agent and a Semantic agent. Also, the QA sub-system can collect/analyze frequent mistakes and problems. The Learning_Angel agent is designed to provide monitoring and syntax checking functions online. While discussing in the class, if learners fall behind the topic of discussing courses, Semantic agent can make some comments and/or suggestions. The statistical analyzer then records, classifies, and analyzes the learners’ discussion. Furthermore, this discussion can be used to generate QA pairs and update the learner corpus. By means of these resources, instructors can revise or enhance their teaching materials. Learners can also learn from the experience of the previous learners and other learners.

This article is organized as follows: we first describe related works and introduce link grammar and ontologies. The next section presents the architecture of proposed system. The chief processes in the proposed system and evaluations of several related systems then are given. The last part of this article gives conclusions and discusses future researches.

THEORETICAL BACKGROUND

Link Grammar

Link grammar is an English grammar parser system that was proposed by researchers at the School of Computer Science of Carnegie Mellon University (CMU). Link grammar is a scheme for describing natural language (Sleator & Temperley, 1991). Link grammar defines a set of words, which are the terminals of grammar, and each has some linking requirements. The linking requirements of each word are gathered in a dictionary. Figure 1 illustrates the linking requirements defined in a simple dictionary for the following words: a/the, cat/mouse, John, ran, and chased.